



In Cooperation with:

U.S. Department of Transportation

Federal Highway Administration

South Carolina

Department of Transportation

P.O. Box 191



Effect on Asphalt Quality Due to Nighttime Construction

Overview

In many areas of the state, traffic congestion places a serious burden on the public and, in some cases, affects the economic vitality of the South Carolina and the region. One way to reduce the congestion effects of roadwork activities is to perform them during nighttime when there is a major reduced traffic demand. However, for many years, the perception has been that construction safety, quality and productivity are impacted by working at night. The major objectives of this project were to identify and analyze the nighttime paving traffic control standards in other states and compare the effects of daytime vs. nighttime paving on quality, safety, costs, and construction time. Tasks in this project included: a comprehensive literature review regarding this topic; a national survey of all State DOTs regarding nighttime paving issues; a survey of SC contractors regarding nighttime paving issues; an investigation of the safety issues involved with nighttime paving in South Carolina, including workers and the travelling public; an investigation of the quality measurements of nighttime paving vs daytime paving (e.g., core compaction data, ride quality, overall pay factors, etc.); an investigation of the costs and construction times of nighttime paving vs. daytime paving; and an investigation of a "reasonable detour" concept used by other states to determine the advantages and disadvantages of the process.

Literature Review

Louisiana DOT officials reported that there is an increase of construction cost (\$5 to \$10/ton) for the night compared to day time paving. Some of the challenges during night time paving include the following: a) road alignment; b) mix segregation and temperature; c) truck beds not clean; d) distance between construction site and the plant; and e) fog. Concerns on the roadway included the following: 1) knowledge of the paving crew regarding the paving plan; 2) more difficult to keep the alignment straight; 3) matching the joint is more difficult; and 4) the workers can't see the mix in the paver and under the augers until it is behind the screed. All of these issues could cause problems with the quality and safety of the end product.

Results

A total of 1728 workzone accidents were analyzed and broken down into the cases that were used for district level analysis and then recombined for statewide analysis. An overwhelming amount of accidents occurred on projects bid as nighttime paving (1,198) compared to daytime bid projects (530). While it is difficult to make a solid conclusion, due to the absence of traffic data, it appears that nighttime paving operations do cause significantly more accidents.

A logit regression was performed on the entire dataset with exception of the missing injury severity data from District 4 to further quantify the difference between projects bid as nighttime paving or daytime paving. When plotted on a heat map, the data only has a range of probability between 62% and 69% (Figure 1). Figure 2 indicates that in every material type except for OGFC, the bid price for nighttime paving was higher than for daytime paving.

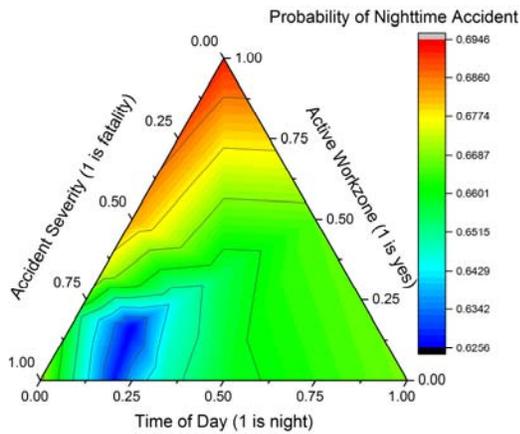


Figure 1. Heat map of accident data for SC.

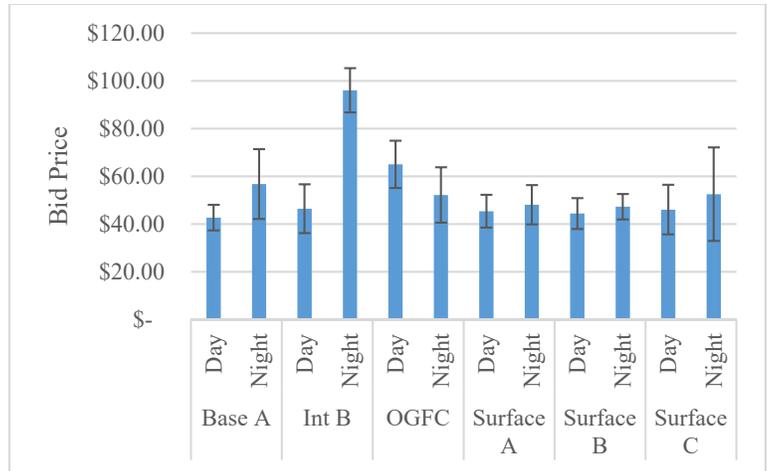


Figure 2. State wide bid price data for six most common mixtures.

Conclusions

In general, nighttime paving operations cause statistically higher accident rates at various points throughout the day and night and with various injury severity. There is approximately a 65% chance that any given accident would be in a work zone that was bid as a nighttime paving operation.

The bid prices (cost of materials per ton) were higher for all mixture types except OGFC for nighttime paving projects compared to the daytime paving projects. However, the relatively large standard deviation for most of the bid prices makes any rigorous statistical comparison impossible.

Generally, the average PWL values for in-place density for daytime projects were higher than the average PWL values for nighttime projects, which could indicate that daytime paving operations lead to higher quality pavements. However, this conclusion is only general and not statistically significant. However, in nearly every case, the standard deviation for in-place density PWL values for daytime paving was less than the standard deviation for nighttime paving. This suggests that even though no statistical comparison can be made of the averages, a more consistent construction procedure is taking place during daytime paving operations, which could lead to higher quality pavements.

With respect to ride quality, nighttime paving projects had significantly more bonus segments, while daytime projects had a significantly higher number of segments receiving 100% pay. Generally, the penalty and repair ride quality segment differences between daytime and nighttime projects was not substantial.

Detours are a viable option, but engineers must consider many factors including materials, traffic count and in-place density of the mat.

Reduced visibility during nighttime paving can adversely affect pavement quality and placement of pavement markings, which can adversely affect pavement life and safety of the driving public on the finished product.

Serji Amirkhanian and Mary Corley were the Principal Investigators for this research project. For further information, please contact Mr. Terry Swygert at SC DOT: 803-737-6652 or swgerttl@scdot.org